Heavy Quark Phenomenology: A Quark Model Perspective

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Study of heavy meson properties within a constituent quark model

- Model parameters constrained by the light quark phenomenology.
- A reasonable description of the studied:
    - Heavy meson spectra.
    - Electromagnetic, strong and weak decays and reactions.

Some relevant results

- The $X(4360)$ as a 4^3S_1 $c\bar{c}$ meson

    - $\psi(4415)$ as a $3D$ state agrees with last measurements of leptonic and total widths.
    - The reactions $e^+e^- \rightarrow D^0D^-\pi^+$ and $e^+e^- \rightarrow D^0D^{*-}\pi^+$:
        - We are not able to reproduce experimental data with only $\psi(4415)$ as an intermediate state.
        - Inclusion of the $X(4360)$ resonance produces a remarkable agreement with experimental data.
    - The decay $X(4360) \rightarrow \pi\pi\psi(2S)$:
        - Calculated within the framework of the QCD multipole expansion.
        - Presence of hybrids near $c\bar{c}$ states produces an enhancement of their hadronic transition widths.

Summary (II)

- Running of the $^3P_0$ strength, γ
  - γ as a function of the reduced mass of the quark-antiquark pair of the decaying meson.
  - The dependence of γ has been taken as logarithmically in the reduced mass.
  - Our results are in a global agreement with the experimental data.

- The $D_{s1}(2536)$ as a $j_q^P = \frac{3}{2}^+$ $c\bar{s}$ meson
  - Particular choice for the coupling between the $c\bar{s}$ states and a tetraquark structure.
  - It simultaneously reproduces the narrow width and the S/D-ratio.

- The semileptonic B (B_s) decays into D^{**} (D_s^{**}) mesons
  - Allow to test meson models as far as they include weak and strong processes.
  - B semileptonic decays into $D_0^*(2400)$, $D_1(2420)$ and $D_2^*(2460)$ in good agreement.
  - $\mathcal{B}(B_s^0 \to D_{s1}(2536)^- \mu^+ \nu_\mu) \times \mathcal{B}(D_{s1}(2536)^- \to D^{*-}\bar{K}^0)$ in agreement.

- Nonleptonic B decays into $D^{(*)}D_{sJ}$ final states
  - Ratios compatible with the experiment. The $D_{s0}^*(2317)$ mass is lowered by 1-loop OGE.
  - Correct ratios are predicted for the $D_{s1}(2536)$ as a $j_q^P = \frac{3}{2}^+$ $c\bar{s}$ meson.
  - $D_{s1}(2460)$ has a sizable non-$q\bar{q}$ component whose contribution has not been calculated.